

What is claimed is:

1. A method of processing a silicon substrate, comprising:  
placing the substrate into a vacuum chamber;  
evacuating the vacuum chamber to a first pressure;  
introducing a fluid other than molecular oxygen into the vacuum  
chamber; and  
implanting ions into the substrate to form a buried oxide layer under a  
top silicon layer, wherein the fluid inhibits formations of threading  
dislocations in the top silicon layer for reducing a defect density of  
the processed substrate.

2. The method according to claim 1, further including selecting the fluid  
from the group consisting of water vapor, heavy water, air, argon,  
and hydrogen gases.

3. The method according to claim 1, wherein the fluid is a hydrogen-containing  
fluid.

4. The method according to claim 1, wherein the fluid is a reducing agent.

5. The method according to claim 1, wherein the fluid is a surface oxide inhibiting  
agent.

6. The method according to claim 1, wherein the first pressure is less than about  $1 \times 10^{-5}$  Torr.

7. The method according to claim 1, wherein introducing the fluid into the vacuum  
chamber produces a second pressure in the vacuum chamber that is less than about  $1 \times 10^{-3}$  Torr.

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8. The method according to claim 1, further including actively controlling the amount of fluid introduced into the vacuum chamber based upon a parameter measured in the chamber.

9. The method according to claim 8, further including selecting the parameter from the group consisting of pressure, water vapor/ion concentration, and temperature.

10. The method according to claim 8, wherein the parameter includes a measurement of an ion beam current.

11. The method according to claim 10, wherein the measurement includes a measurement of a decrease in the beam current due to the fluid in the chamber.

12. A method of processing a substrate, comprising:  
placing the substrate into a vacuum chamber;  
evacuating the vacuum chamber to a first pressure;  
introducing a fluid into the vacuum chamber; and  
implanting ions into the substrate using an ion beam to form a buried oxide layer under a top silicon layer;  
measuring a decrease in the ion beam current level due to the fluid in the chamber; and  
adjusting the fluid level based upon the measured ion beam current level.

13. The method according to claim 12, further including the step of selecting the fluid from fluids that inhibit formations of threading dislocations in the top silicon layer for reducing a defect density of the processed substrate.